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**A NEW SPECIES OF *CYLINDROBULLA*, SACOGLOSSAN
OPISTHOBRANCH, FROM CALIFORNIA; WITH A COMPARISON
WITH *C. JAPONICA* HAMATANI, 1969¹⁾**

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With Plates VI-VII and 3 Text-figures

Six preserved specimens in alcohol, which appear to be closely allied to *Cylindrobulla japonica* HAMATANI, 1969, accompanied with the biological notes on them and two excellent colour-slides, were sent to the author in July, 1970 by Dr. Allyn G. SMITH, Associate Curator, Department of Invertebrate Zoology, California Academy of Science. These specimens had been found together with other nine specimens of the same species in his collection of preserved invertebrates, which were collected by his Assistant Curator, Mr. Dustin D. CHIVERS, on a green alga, *Caulerpa*, off Isle Espíritu Santo in the Gulf of California in August, 1965. Detailed examinations on the specimens in the author's hand revealed that they were conspecific, seemingly new to science, and belonging to the genus *Cylindrobulla* P. FISCHER, 1856. The specific features of the shell and radular teeth of this new species are given preliminarily in the present paper on careful comparison with those of *C. japonica*.

Two more species belonging to the genus *Cylindrobulla* from the world are added in the paper of MARCUS & MARCUS (1970, pp. 25 and 26) (see HAMATANI, 1969, p. 171); these are *C. turtoni* BARTSCH, 1915 from South Africa and *C. systremma* MELVILL, 1918 from the Gulf of Oman. Furthermore, the species of MARCUS & MARCUS (1956) from Brazil, which had been shown only as *Cylindrobulla* sp. in studying its anatomy, was recently named *C. ulla* as a new species (MARCUS & MARCUS, 1970). Thus, the present new species is the eleventh member of the genus in the world.

Before going further, the author wishes to express his hearty thanks to Dr. A. G. SMITH for very valuable specimens and notes treated in his work, and again to Dr. SMITH and Mr. J. T. CARLTON of California Academy of Science, and Dr. Y. MIYA of Kyushu University, for their kindness to supply him with copies of papers indispensable for the present study.

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Cylindrobulla californica sp. nov.

Habitat: The Gulf of California: Isle Espíritu Santo, Bahía San Gabriel. On the colony of *Caulerpa*, together with *Berthelinia chloris* (DALL).

Collector: Mr. Dustin D. CHIVERS; Assistant Curator of Dr. A. G. SMITH.

Date: August 13, 1965.

Material: Six specimens, measurements of their shells are:

No.	Specimen	Length	Breadth
1.	Adult (Holotype)	5.0 mm	2.5 mm
2.	Juv.? (Paratype 1)	3.6 mm	1.8 mm
3.	Juv. (Paratype 2)	3.0 mm	1.7 mm
4.	Juv. (Paratype 3)	3.0 mm	1.8 mm
5.	Juv. (Paratype 4)	2.5 mm	1.7 mm
6.	Juv. (Paratype 5)	3.0 mm	1.7 mm

Holotype and paratypes Nos. 3 and 4 (Sp. Nos. 4 and 5) are preserved in 70% ethanol and now in the custody by the present author. Paratype No. 1 (Sp. No. 2) was cut into horizontal serial sections for a morphological study of internal organs in future. While paratype Nos. 2 and 5 (Sp. Nos. 3 and 6) were dissected for the studies of radular teeth and protoconch of the shell.

Descriptions: The shell is dextral, cylindrical in shape, and very thin and flexible, but fragile as usual in this genus. The periostracum is transparent, colourless and thin, so that the snow-white calcareous layer is seen through it. The aperture is as long as the shell and very narrow; it is obliquely truncated in front and extends linearly to the top of the shell, where it turned a little backwards along the suture of the body whorl to form a narrow sutural slit. The end of sutural slit is closed perfectly in all specimens, in the holotype at about the two-thirds of the body whorl (Text-fig. 1 B, Pl. VI figs. 3, 4); in all examined specimens of *C. japonica*, however, the sutural slit is very deep, coiling about one time or more, though becoming narrower suddenly at about the two-thirds of the body whorl (Pl. VII figs. 3, 4).

The spire is completely sunken in the apical umbilicus, but the protoconch is seen wholly from the dorsal side at the centre of the umbilicus bottom. The slant of the raised margin of the inner lip forming the sutural slit is not so steep as in *C. japonica*. A crest extends along the suture from the end of the sutural slit towards the protoconch. The crest is formed by the body whorl in contact with an extension of the inner lip of the sutural slit and is coiling about one time. In contrast with this, in *C. japonica* the crest is inconspicuous. In the present new species the umbilicus is comparatively larger than in *C. japonica*. The ratio of the diameter of the spire, measured across the protoconch between the outer margin of the sutural slit and the opposite suture line represented by the crest (Text-fig. 1 A, X), to the maximal breadth of

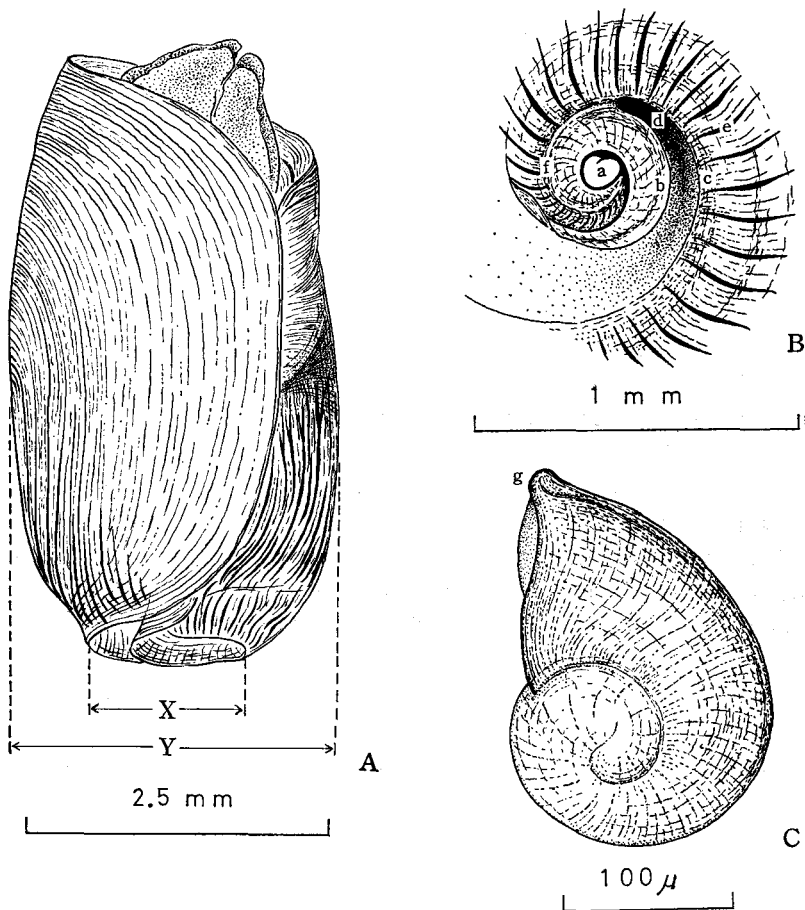


Fig. 1. *Cylindrobulla californica* sp. nov.

- A. Preserved holotype seen from the right side. X, diameter of spire; Y, diameter of shell.
- B. Spire of shell seen from above, paratype No. 2. a: Protoconch. b: Inner lip of sutural slit. c: Outer lip of sutural slit. d: Sutural slit. e: Strong radial striae on body whorl. f: Crest on the suture line, formed by inner and outer lips of sutural slit.
- C. Protoconch of paratype No. 2. g: Swollen portion on aperture edge.

the shell (Text-fig. 1 A, Y) is 1 to 2.0 or less, while in *C. japonica* the ratio is 1 to 2.5 or more. The protoconch is nearly of the same size in both the present new species and *C. japonica*; in the former it has a characteristic swelling on the left margin of the aperture as shown in Text-fig. 1 C and Pl. VI fig. 2 in two examined specimens, while in the latter this unique protuberance is missing in four examined specimens (HAMATANI, 1969, Pl. VI fig. 4).

The shell surface is longitudinally striated densely except the range along the outer lip of aperture, about a quarter as wide as the shell breadth. The surface of

the body whorl which is seen from the above is also striated regularly with strong radial sculptures (Text-fig. 1 B, e) up to the bottom of the umbilicus. In *C. japonica*, there are only a few striae on the shell surface, and radial sculptures on the spire are less remarkable as compared with the same feature found in the present new species.

The radular teeth are just similar to those of *C. japonica*, they are uniserial and of a typical sacoglossan style. The radula of paratype No. 2 consists of 25 teeth in all, 6 teeth in the ascending and 19 teeth in the descending series, besides a rod-like preradular tooth. The paratype No. 5 also bears the same number of teeth respectively in the ascending and descending series. The tooth is blade-like in shape and curved a little more (Text-fig. 3 C) than in *C. japonica* (Text-fig. 3 D), in which the ventral edge of the tooth-blade runs down nearly straight from the tip of the blade to the convex of its base. The tooth has a series of slender denticles, nearly as many as in *C. japonica*, on each side of the blade, though the denticles in the present new species seem to be rather shorter than in *C. japonica*.

Remarks: The present species is allied very closely to *C. beaufi* P. FISCHER, 1856, the type species of the genus, in shape of the shell, especially in the state of the sutural slit (cf. MARCUS & MARCUS, 1970, Fig. 27). But the former differs very distinctly from the latter in the following aspects. Firstly, the body whorl is transparent in *C. beaufi* (see MARCUS & MARCUS, 1970, p. 23) but snow-white in colour in the present new species. Secondly, the feature of radular teeth differs much between the two. MARCUS & MARCUS (1970) mentions on the radula of *C. beaufi* as: "Radula uniserial,

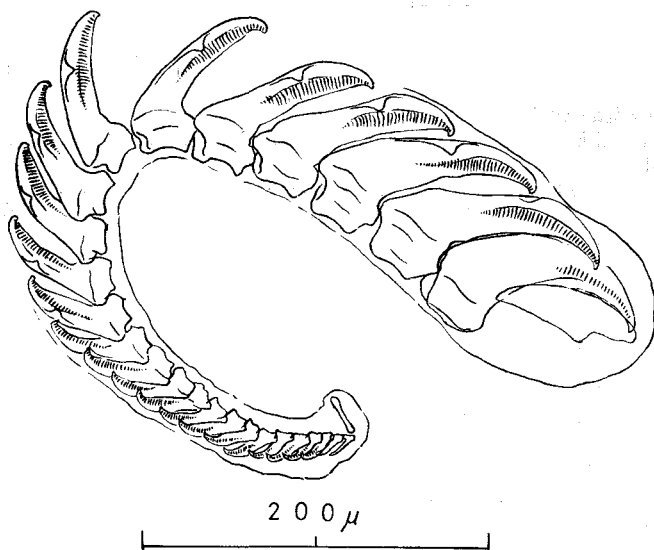


Fig. 2. *Cylindrobulla californica* sp. nov.
Whole radular teeth of paratype No. 2.

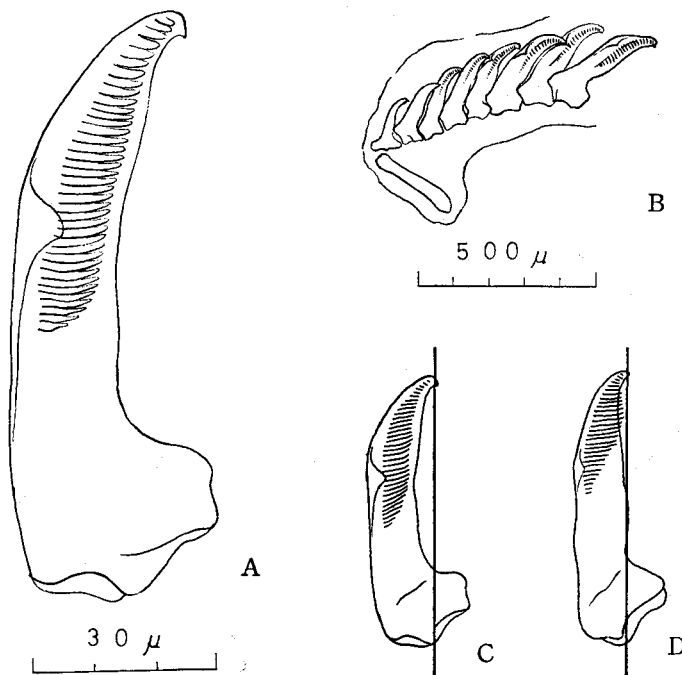


Fig. 3. A-C: *Cylindrobulla californica* sp. nov. D: *C. japonica* HAMATANI.

A. A tooth from paratype No. 2, lateral side.

B. A part of descending series of radula of paratype No. 2, to show a "pre-radular tooth".

C and D. Comparison of the curvature of ventral edge of the tooth blade between *C. californica* (C) and *C. japonica* (D). A line is drawn from the tip of the tooth to the convex of its base.

with dorsal and ventral limb of nearly equal size. Snail from Curaçao 80 teeth, biggest from Florida 100. Oldest teeth shed, not retained. Shape of tooth similar to rhachidian tooth of *Toledonia* (ODHNER 1914b, pl. 1 figs. 6, 8) and *Microhedyle* (MARCUS 1954, fig. 16), not dagger-shaped as in many Ascoglossa. Newest teeth of Curaçao snail (Fig. 31) 34 μ broad, 29 μ high, with central cusp flanked by 4-5 denticles. In biggest animal from Florida (Fig. 30) 4-7 denticles, the innermost of which nearly as high as cusp." The tooth of the present new species is rather similar to that of *C. ulla* (MARCUS & MARCUS, 1970, p. 108, fig. 33), but the shell length in *C. ulla* is much less (2mm) than in the present new species.

As stated by MARCUS & MARCUS (1970) on page 24, the radular teeth of the specimens collected from the West Indies and identified with *C. beai* P. FISCHER by them resemble closely the rhachidian teeth of some opisthobranchs (*Toledonia* of Cephalaspidea and *Microhedyle* of Acochlidoidea as noted), but differ so much from the tooth type common to *C. japonica* HAMATANI, *C. ulla* MARCUS & MARCUS, and *C. californica* HAMATANI that, if the specimens treated by MARCUS & MARCUS are

really *C. beaui* originally described by P. FISCHER, these three species will need a new genus to include them and separate them distinctly from *Cylindrobulla beaui* P. FISCHER, although a number of species have to be left *provisionally* in the genus *Cylindrobulla* as they were established on only their shell morphology. As seen readily in the present description, the differentiation in the shell morphology may be extremely exact in some species. Then it is naturally beyond my ability to judge the exactness of the identification of MARCUS & MARCUS on their *C. beaui* from the West Indies, with no chance of examining some of the West Indies specimens treated by them. This problem is better left for further studies.

Summary

1. Six specimens of a shell-bearing sacoglossan opisthobranch belonging to *Cylindrobulla* P. FISCHER, 1856, collected in August, 1956 from the caulerpan colony growing in the Gulf of California by Mr. D. D. CHIVERS, were submitted to the author's examination through the courtesy of Dr. A. G. SMITH.

2. These specimens were conspecific and named newly *Cylindrobulla californica* for their morphology of the shell and radula which differ slightly but distinctly from those of *C. japonica* HAMATANI, 1969.

3. If the radula of *C. beaui* P. FISCHER, 1856, the type of the genus, is really constructed as is shown by MARCUS and MARCUS (1970), a new genus should be established to include *C. ulla* MARCUS and MARCUS, 1970, *C. japonica* HAMATANI, 1969 and *C. californica* n. sp. described here.

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EXPLANATION OF PLATES VI-VII

Plate VI

Cyllindrobulla californica sp. nov.

- Fig. 1. The holotype, preserved, seen from different sides (a, dorsal; b, ventral; c, right; d, left).
- Fig. 2. Protoconch of paratype No. 2, shown in text-figure 1 C.
- Figs. 3 and 4. Shells from above. 3, holotype; 4, paratype No. 2, shown in text-figure 1 B.
- Fig. 5. Radular teeth of paratype No. 2, shown in text-figure 2.
- Fig. 6. First two teeth of the descending series of the radula shown in Fig. 5.

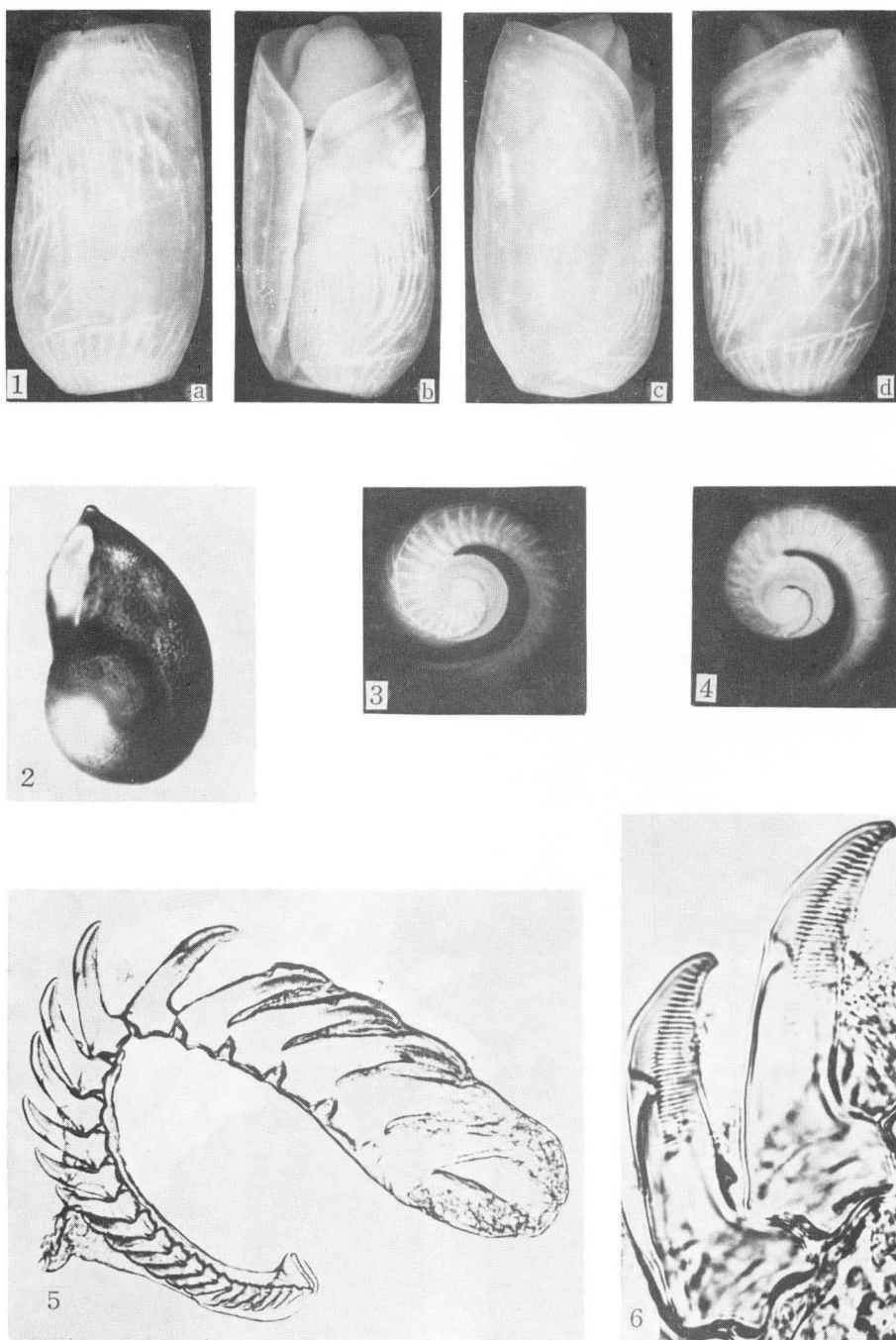
Plate VII

Figs. 1-4. *Cyllindrobulla japonica* HAMATANI, 1969

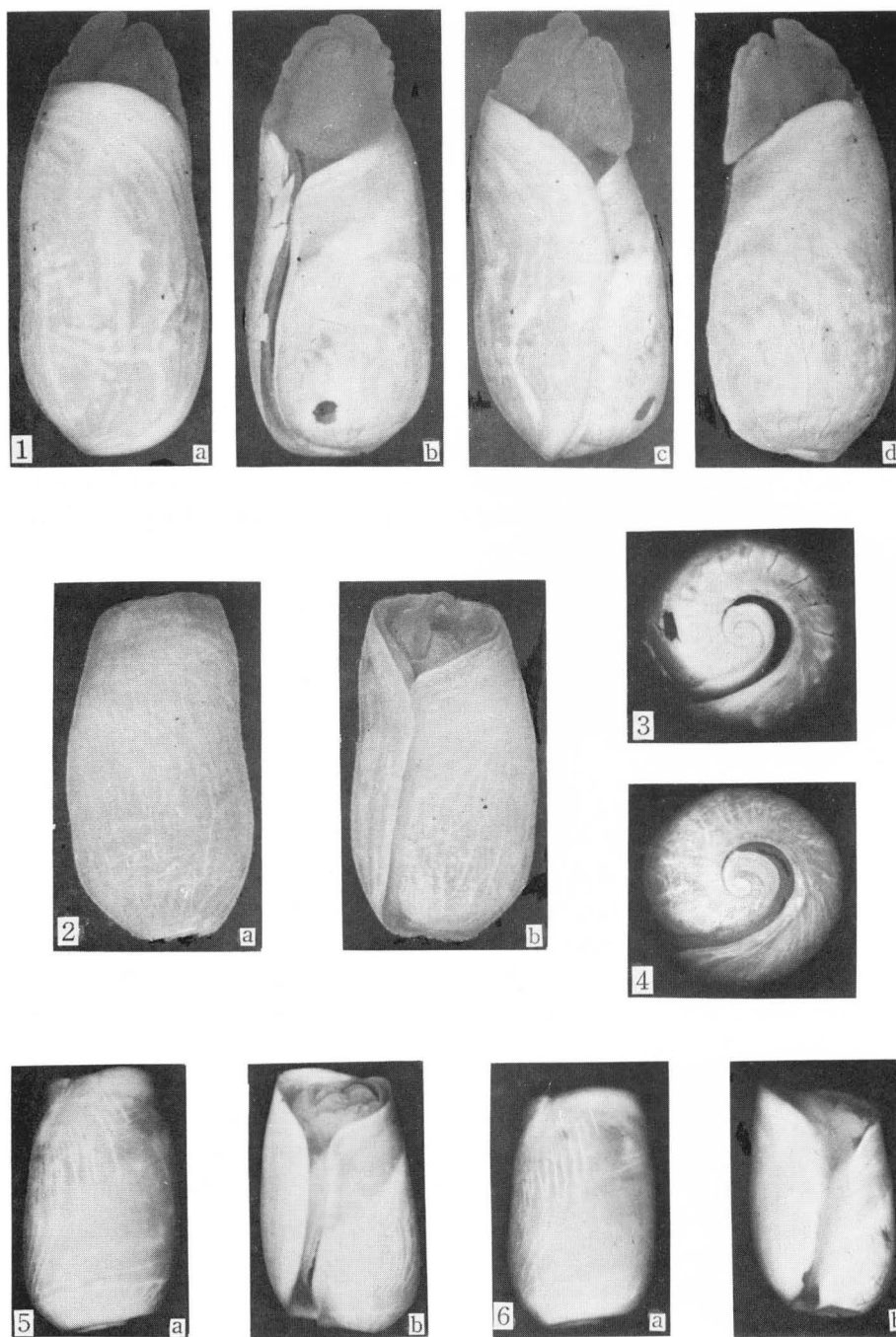
- Fig. 1. The holotype, preserved, seen from different sides (a, dorsal; b, ventral; c, right; d, left).
- Fig. 2. Paratype No. 3, preserved, seen from dorsal (a) and ventral (b) sides.
- Fig. 3. Shell from above, holotype.
- Fig. 4. The same in paratype No. 3.

Figs. 5 and 6. *Cyllindrobulla californica* sp. nov.

- Fig. 5. Paratype No. 1, preserved, seen from dorsal (a) and ventral (b) sides.
- Fig. 6. Paratype No. 2, preserved, seen from dorsal (a) and ventral (b) sides.



I. HAMATANI: *A New Cylindrobulla from California*



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